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Call for Action: Designing for Harmony in Creative Teams

Mateusz Dolata and Gerhard Schwabe

University of Zurich, Department of Informatics, Zurich, Switzerland
{dolata,schwabe}@ifi.uzh.ch

Abstract. Competitive markets force diverse organizations to intensively manage innovation. Many of them set up multifunctional teams responsible for generating novel and original ideas. Such teams often face higher risk of conflicts and tensions, being an inherent part of creative processes. Impact of this phenomena on creative performance of teams, even though extensively addressed in research, remains unclarified. We approach this issue while providing a novel interpretation framework inspired by the concept of *harmony* in *jazz improvisation*. We apply it to observations made with project teams in an organizational setting, and use it to inform design of a supporting collaborative solution. We postulate the need for further work on team *harmony* and creativity.

Keywords: creativity; harmony; jazz improvisation; task conflict; teamwork;

1 Introduction

The importance of innovative ideas in organizations has grown over the last decades. Creative performance of teams plays an important role in this change and requires a close consideration. Still, some aspects of group creativity remain unclarified, particularly in the longitudinal, organizational context. A prominent case is the phenomenon of intragroup disagreements or confrontations, hitherto interpreted and intensively researched in the context of team or group conflict. The output is a partially contradictory and inconsistent body of knowledge [16, 51, 75], failing to provide clear prescriptions regarding collaboration engineering and the design of appropriate support systems. The insufficiency may hails from the inadequate framing of relevant findings. Therefore, we introduce a framework relying on the concept of *harmony* in creative teams. It originates from the *jazz improvisation* (JI) metaphor already considered in a variety of contexts [27], including organizational change. In order to motivate the relation between JI and creative performance, a closer look at the organizational context of creativity, i.e., innovation is discussed.

Innovation used to be considered anything, but business as usual. Recently, the paradigm has changed, while turning innovation into an inevitable element of business and society. Due to the highly competitive markets and customer demands, role of innovation management has grown to become one of the organization core business processes [28, 68]. Simultaneously, the interest in creativity support has arisen.

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The dependency between creativity and innovation is widely discussed [3, 14, 74]. While creativity is about conceptualization or development of *novel* and *useful* ideas for products (*value creation*), innovation is about implementing them in organizations (*value capture*) [2, 25, 74]. Other important factor is the *idea novelty*. Changes applied in the course of innovation processes possess the degree of *relative* novelty, while creativity results in *absolute* novelty [3, 14]. This distinction emphasizes the role of creativity for radical innovation. While incremental changes often emerge from work practices, radical ideas with large impact flourish under specific circumstances, such as dedicated environments or particular organizational climate [70]. One of the methods proposed within the concept of ambidextrous organizations [52] are separate divisions for exploratory and traditional units, possibly organized in teams.

Executive, administrative and other 'daily business' teams are expected to have different dynamics than creative teams, particularly due to the differences in goal setting [36, 37]. While using the analogy to music in general [1, 44], one could compare the traditional action teams to classical music ensemble, who interpret the masterpieces of art in a predefined, precisely described frame. At the same time, creative teams exhibits similarities with jazz musicians [6, 27], who improvise using underspecified 'minimal structures' [4, 35] to create *melody* through 'the suddenly arisen harmonic organization' [6]. Considering the managerial sciences, JI is primarily applied in the field of organizational change and innovation strategies [24, 35, 46, 72], as well as marketing [27]. In limited scope, it is also used to moderate creative collaboration in groups [6, 13]. Regardless of how popular is the analogy based on melody composition in jazz, *harmony*, also an important dimension of music, has not yet been attended extensively.

In the context of music, *harmony* "directs the attention to how patterns of *consonance* and *dissonance* unfold over time" [1]. It describes the relationship of tones as they sound simultaneously, as well as the organization of such relationships in time [60]. Whereas in classical music, *harmony* is the responsibility of the composer and the interpreter influences it only in a limited way, jazz musician take care of the *harmony* while they improvise [63]. They create high-tension moments through *dissonances* and resolve them on the go, through movement towards consonant intervals. In general terms, *dissonance* in music describes a situation when simultaneous combination of two or more frequencies is experienced as unpleasant. Recent studies show, that generalization of such experiences is somewhat possible [76]. Speaking figuratively, if somebody hits several 'incompatible' piano keys at the same time, the sound will be experienced as unpleasant by most of the listeners. *Dissonance* can vary in its intensity, and to a certain degree it is included in most music pieces generally considered harmonious, including even great masterpieces of classical music, not to mention spontaneously emerging jam sessions.

Terms like *harmony*, *consonance* or *dissonance* hardly ever appear in literature on innovation management, and if so, mostly without deeper grounding in the theory. Different authors refer to *harmony* when addressing topics such as cultural differences [29], team constellations [49], and team effectiveness [45], in the context of intragroup tensions or incompatibilities. However, they do not explain the analogy. Instead, they fall back to the well-established concepts from psychology, such as con-

flict and agreement. We, acknowledge that there exist a relation between the notions of conflict and *dissonance*. In particular, when considering task conflict as incompatibility of activities rather than dissent of goals [69], the analogy to the incompatibility of tones becomes obvious. In this situation, analyzing current literature on performance and conflicts in creative teams, as well as its shortcomings, seems to be the appropriate starting point.

Group creativity is approached by a vast amount of studies and is addressed by numerous literature syntheses [30, 47, 51, 56–58]. Due to the high capacity for cross-breeding of concepts, ideas and values, groups are considered potentially more creative than individuals or nominal group [55, 58, 67]. However, it is met with concern how little is known about turning this potential into real value [20, 40]. On the one hand, organizational scientist address creativity mostly on the level of individuals [20, 57]. On the other hand, psychology research discusses collective creativity, primarily, while considering brainstorming performance in lab experiments [21, 31]. Nevertheless, the emerging body of knowledge provides evidence for positive relation between creative performance and numerous other attributes, such as team size and diversity, as well as task and goal interdependence, shared vision, participative safety, task orientation and communication [30, 57].

Role of conflict and related factors for creative groups is frequently addressed in psychology and in organizational science [51]. Jehn [31] classifies team conflict into three categories: task conflict, relationship conflict, and process conflict. Studies prove the latter two to be detrimental to creative processes in groups. Interestingly, given this framing, no clear statement can be made in favor or against task conflict [51]. Still, any kind of disagreement and disharmony in groups may result in relationship conflict, thus negatively influencing creative performance [31, 75]. This is analogous to the *dissonance* produced by incompatible chords in a jazz performance, which, if not resolved or accented properly, may result in a poor aesthetic impression overall. We want to extend on this notion of group performance, while answering the first research question:

RQ1. What is the constitution of team harmony in creative teams?

As indicated before, conflicts may have negative influence on creative teams and lead to detrimental effects in a wider context. While there exist multiple IT systems to support creative teams at work through enhancing stimulation or providing means for parallelization of idea production, little has been done to support management of overall *harmony* in this specific situation [43, 71]. Given the importance of creativity for the value chain of modern organizations and potential influence of *dissonance* on creative performance, we seek to provide information on the following:

RQ2. How to support teams at maintaining harmony by means of IT?

This contribution is structured along these research questions. In the first line, it describes a literature study addressing the *harmony*-related issues in creative teams. It then provides a short summary of an exploratory study conducted prior to the literature review, which however confirms its results. Afterwards, implications for research and work practices are discussed.

2 Methodology

Overall structure of this study follows the paradigm of *Design Science Research* (DSR) [26]. In the introduction, we present the practical relevance of creative team research for organizational science and particularly emphasize on *harmony*, as a potentially influential factor for their performance. Second, we conduct a rigorous literature review of psychology and managerial science articles to analyze work done on conflict in the context of creativity. This leads to a synthesis of our working hypothesis on the potential of team harmony and related constructs, a kernel theory, complemented with prescriptive statements on creative group work. The proposed kernel theory is then evaluated based on observations made during an exploratory study done prior to the literature review. On the one hand, this procedure enables a better understanding of the observed events and tendencies. On the other hand, it deals as a first, limited and necessarily subjective [23, 48] sieve for the proposed set of assumptions and solutions. The above process forms the first cycle described in this paper, in which the concept of team harmony is treated as the artifact under consideration.

Subsequently, we discuss the possibilities of supporting harmony in creative teams. We attempt to match the developed requirements to existing group support systems addressing creativity. Due to the limited outcome of this inductive elaboration, we deduce an exemplary approach resulting from the concept of harmony. We finalize while proposing design principles that rely, primarily, on conceptual, value and explanatory grounding [21]. The remainder of this section addresses the particular methodologies applied to collect data.

The process of the literature search is aligned to the guidance proposed by vom Brocke [7]. We certainly acknowledge the need for documenting the literature search, as well as the literature selection process [53]. Our review is structured accordingly.

To collect a body of knowledge on relation between *harmony* and creativity, we started with querying several databases with use of the search service offered by *EBSCOhost* (www.ebscohost.com). We limited the choice of active databases to the following ones: *Academic Search Complete (ASC), Business Source Premier (BSR), eBook Collection, EconLit, ERIC, Information Science and Technology Abstracts, PsycARTICLES, PsycBOOKS, PsycEXTRA, PsycINFO, SocINDEX*. We used the following terms connected by Boolean 'AND' to query the databases: *'conflict management team creativity'*.[1] The overall number of hits including all listed terms was 122 (out of them 44 in *BSR*, 27 in *PsycINFO* and the remaining ones distributed over other databases) and after duplicate removal 82. All returned articles were published between 1980 and 2013. Review of all those contributions is out of scope of a confer-

[1] In our first tries, we queried the databases for concepts related to harmony in creativity, but quick investigation of results did not yield any or very few relevant hits (number in parenthesis represent overall hits in scholar journals and the relevant ones given the broad context of this article): *harmony innovation team (9/1), dissonance innovation team (2/0), consonance innovation team (0/0), harmony team creativity (3/1), consonance team creativity (0/0), dissonance team creativity (3/1)*. Given those results, we decided to focus on the well-established concept of *conflict management*, which we consider related to harmony, and extend the results by means of forward and backward search if possible (cf. Section 1).

ence paper, therefore we selected a subset according to the following criteria based on the coding of abstracts and titles.

- Focus primarily on creative teams or design teams or innovation teams;
- Focus on dynamics of teams (rather than team constant attributes like diversity);
- Reference to *harmony*, *conflict* or *conflict management* in the title or abstract;
- Journal listed in the *Association for Information Systems* (AIS) summary of MIS Journal Rankings [62] extended by the journals in the field of *innovation and technology change management* from the ABS Journal Quality Guide [22].

This procedure yielded a set of 19 journal articles meeting all the criteria. As none of the detected literature reviews referred to conference publications, we decided not to conduct extensive search in the conference proceedings. Instead, we manually assessed articles from the ACM Creativity & Cognition conference proceedings from last 5 years and extended the results set by two further articles. Additional review of ICIS 2013, ECIS 2013, and DESRIST 2013 proceedings did not provide any hits. However, backward and forward search [73] added another 26 journal articles, primarily from the flourishing field of psychological research on brainstorming performance. For the sake of precision and continence of the current publication, we give preference to studies conducted in organizations and/or with long term perspective, as well as pertinent meta-analysis, that were published between 2000 and 2013. Table 1 (p. 7) presents the final set of eleven studies along with additional comments and a summary of findings.

To collect knowledge on existing systems addressing needs of innovation and creative teams we applied a procedure similar to the above one. To start the search process, we query for *'creativity support information systems'*. This search returns 268 hits (345 before the removal of exact duplicates: 146 in *BSR*, 129 in *ASC*, and the remaining ones distributed over other databases) from years 1980 – 2013. We apply the following criteria to the articles based on their titles and abstracts:

- Focus on information systems and technology research.
- Reference to influence on creative or innovative performance.
- Focus primarily on creative teams or design teams or innovation teams.
- Journal listed in the AIS summary of MIS Journal Rankings [62].

This procedure returns 22 results compatible with all criteria. Review of conferences, analogue to the one mentioned earlier, yields further three contributions. Forward and backward search [73] extends this list by another nine positions. Regrettably, none of the systems or designs in the resulting set of studies directly approaches *harmony*, tensions or conflicts in creative teams in an organizational context. An extensive review goes, therefore, beyond the scope of this publication. Nevertheless, we address findings from this review in Section 5, while describing an exemplary system to support *harmony* in creative teams.

Another part of the current contribution, the exploratory study, relies upon observations made with ethnographically informed methods [23, 48] in a specific organizational context. It was conducted within a graduate course at a European University, in which students are encouraged to apply *Design Thinking* (DT) on a real-life innovation challenge, offered by industry partners. DT is a human-centered approach laid out along a structured process in order to produce breakthrough innovation with value

to organizations and society [8, 17, 59]. It is an iterative procedure addressing need-finding, ideation, prototyping, testing, and (re)defining. This cycle is applied repeatedly along a process starting with a design space exploration, followed by long divergent and convergent phases, until finalization in a single prototype [11]. Characteristic for this approach is the demand for high ambiguity of ideas and prototypes to be achieved in the first stage of the project and number of choices to be made along the way towards the final prototype. Consequently, teams are exposed to major tensions at any point of time [65]. Even though, DT itself encourages *harmony maintenance*, teams encounter problems related to their diversity and distributed collaboration setting. Our study in the context of DT course focuses on three teams working from September 2012 to June 2013, with no breaks in between. The teams are coached by DT experts in two weekly sessions: once on the course level and once on the team level. Observations made in several of those sessions, as well as non-structured interviews with coaches and team members serve as basis for the study described in Section 4. Particularly, we focus on the occurrence of incompatible tendencies in teams, and on whether and how the team approaches them on its way throughout the course.

3 Theorizing on Harmony

The existing literature does not explicitly approach the holistic notion of *harmony*, as introduced in the current contribution. It does, however, extensively discuss the influence of tensions and conflicts on team performance, and in particular, creative performance [69]. However, as opposite to the role of *dissonance* in music, the impact of task conflict in creative teams has not been yet fully clarified [30, 51], though it is considered a relevant variable [56]. Resolving the conflict dilemma is out of scope of this publication. Instead, we propose a concise literature review and identify the most relevant constructs and relations to motivate our *harmony*-centered model of creative performance. Based on the extensive literature review described earlier, we selected a number of papers summarized in Table 1. We primarily included studies conducted in organizational context – we follow the assumption that this context, including team or work group history and goals, substantially moderates the important relationships. Also, we considered studies that generate or mimic such organizational context in university circumstances, if the observations made have a longitudinal character. Finally, we refer to two extensive literature meta-analysis to show the general tenor on relationship between conflict and creative performance of teams.

Even a short peek on the table unveils the main problem, confirmed by the meta-reviews [30, 51]: no clear, linear relation between task conflict and creative performance can be established. Whereas some studies suggest a linear or curvilinear relationship, others prove further dependence on project phase or team type, and additional factors like information exchange or participative safety. The picture does not get clear, even if laboratory studies in psychology, excluded from this review, are considered [56, 69]. Designing a system to address tensions in creative teams would be, in this situation, at least cumbersome. That is where the *harmony*-oriented approach comes into play.

Table 1. Selection of the reviewed articles on conflict and creativity sorted chronologically; along with the most relevant, statistically significant findings given the current topic. CP stands for *creative performance*, TC for *task conflict*, RC – *relationship conflict*, PC – *process conflict*. The notation used for results: A × B stands for *the correlation between construct A and construct B*, ↑ depicts a *positive* relation, and ↓ – a *negative* one.

Reference	Character of study	Relevant variables	Relevant results
Jehn and Mannix, 2001 [33]	longitudinal, survey-based, university, project teams	TC, RC, PC, team CP, project phase	TC × project phase = inversely U-shaped for teams with high CP TC × project phase = ↑ (sign. grow of TC in late phase) for teams with low CP
Lovelace et al., 2001 [42]	survey-based, organization, new product project teams	task disagreement (~ TC), innovativeness (~ CP)	TC × CP = ↓, moderated by *freedom to express doubts* and *collaborative* or *contentious* character of communication
Kurtzberg and Mueller, 2005 [41]	self-report-based, longitudinal, organization, teams	TC, RC, PC, individual CP, team creative synergy	TC × individual CP = ↑ one day after TC occurs TC × team creative synergy = ↓ at the day TC occurs
Chen, 2006 [12]	survey-based, organization, project teams	TC, RC, team CP	TC × CP = ↑ in technology oriented teams RC × CP = ↓ in service oriented teams
De Dreu, 2006 [15]	survey and interview-based, organization, various teams	TC, team CP, information exchange, collaborative problem solving	TC × CP = inversely U-shaped (slight shift towards low level of TC) TC × information exchange = inversely U-shaped TC x collaborative problem solving = inversely U-shaped
Kratzer et al., 2006 [38]	survey-based, organization, project teams	team polarity (~ TC), team CP, project phase, degree of innovation	team polarity × CP in incremental innovation or late innovation phase = ↓ team polarity × CP in early innovation phase = inversely U-shaped (i.e., CP high at moderate level of CT, CP lower if CT high or low)
Hülsheger et al., 2009 [30]	meta-analysis, literature based	TC, RC, cohesion, internal communication, team CP	CP × cohesion = ↑ ; CP × internal communication = ↑ ; no significant results for TC or RC
Farh et al., 2010 [19]	survey-based, organization, project teams	TC, team CP, project phase	TC × CP = inversely U-shaped in the early project phase (slight shift towards high level of TC)
Jehn et al., 2010 [32]	in-class experiment, organization, work groups	conflict asymmetry, group CP	group task conflict asymmetry* × group CP = ↓ * the degree of dispersion in group regarding perceived conflict
Fairchild and Hunter, 2013 [18]	longitudinal, survey-based, university, design teams	TC, participative safety, team CP	TC × CP = ↑ only if high participative safety; low TC and low participative safety correlate with most original solutions
O'Neill et al., 2013 [51]	meta-analysis, literature based	TC, RC, PC, team type, performance, team CP	TC × team perf. = ↑ in decision-making; ↓ in production and project teams no significant results for TC, PC or RC × team innovation performance (~ CP)

On the one hand, team *harmony* stems from the previously mentioned JI metaphor. This results in the vocabulary choices and dependencies between constructs that describe the overall team *harmony*. On the other hand, it uses findings from the field of managerial sciences and psychology addressing the task conflict and intragroup tensions. This twofold motivation assures compatibility of the presented paradigm with the JI-motivated literature as well as the actual behavioral knowledge base.

An important issue in improvisation music is the ongoing *listening* to each other [13, 27]. This is a specific form of communication, as the message constructed by one musician (*melody*) is primarily not directed at the band, but the audience. Still, it is implicated that band members receive the message and interpret it appropriately. Also the creative teams mostly generate solutions addressed at external audience (users, customers, and partners), still the communication within the team remains substantial to the management of conflicts and tensions, as well as the creative performance [15, 42]. This dimension of *harmony* is referred to as *mutual listening* in our model.

As discussed before, jazz musicians, especially in jam sessions, generate *dissonances* to provide an emotionally involving performance. *Dissonances* are also natural to the creative processes, and as some research suggests, may be beneficial to the overall output. Still, as Jehn et al. [32] conclude, differences or lacking awareness of them may be detrimental to work performance. Therefore, we postulate that teams need to develop *dissonance awareness* and shall be supported at it.

Finally, if *dissonances* occur, *harmony* requires to manage them. Some *dissonances* are resolved straight away towards *consonance*, some others are deliberately accented and resolved afterwards. This process does not require dedicated reflection, but happens along the course of improvisation. Several studies provide evidence for a curvilinear dependency between conflict and creativity, others suggest moderating effects of, e.g., collaborative atmosphere [18, 19, 33, 42]. We follow up on their findings and postulate the importance of *dissonance resolution* in creative teams. Fig. 1 depicts the proposed *harmony* oriented view on creative performance along with the appropriate design requirements, to be considered when addressing this issue in collaboration engineering or design of creative support systems.

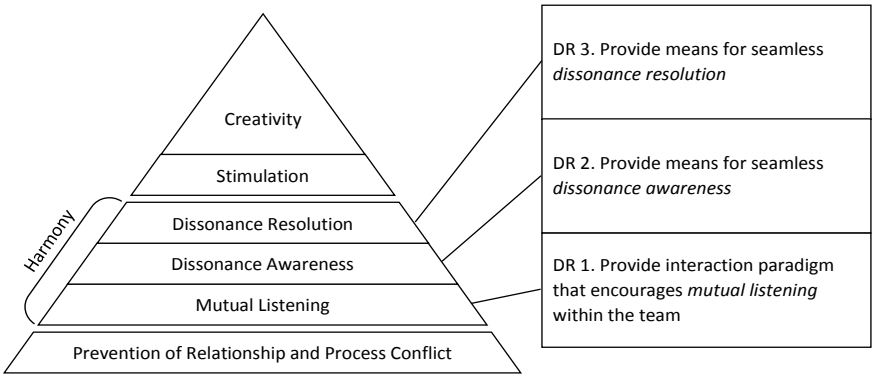

Fig. 1. *Harmony*-oriented view of creative performance and resulting design requirements

4 Exploratory Study

This exploratory study deals as an evaluation of the proposed *harmony*-oriented model of creative performance. At the same time, it motivates the design of a mechanism that shall support creative teams at maintaining their *harmony* while preserving most successful work practices. We focus on three teams chosen to represent the variety of collaborative settings encountered in the design thinking course. At the same time, those teams exhibit different patterns of *harmony*. All teams are working according to the same process and follow the same three milestones. They, also, use similar IT infrastructure mix, including a wiki page for documenting purpose, file sharing services and social platforms for asynchronous work, as well as IM-messaging and video conferencing for synchronous communication. Additionally, video and picture sharing platforms are used as a storage for the respective media.

Team A consists of seven members of two universities on different continents. Their challenge addresses innovative service design task for financial industry. Team members use the whole range of communication media, including biweekly video conferences. All of them also meet twice in real in the course of the project. Nevertheless, knowledge gaps arise regarding the state and objective of particular tasks. *Mutual listening* fails particularly at the boundary between the two participating universities. As the task conflict lasts for almost 90% of the project duration, it turns into process conflict. The team performance at the first and second milestone is below the average. The team is aware of the *dissonance* and seeks for its resolution during the final real meeting, short before the deadline. Team surprisingly performs above the average. The final prototype improves significantly over the last days during the final co-located session.

Team B consists originally of five students, however one lefts after the first milestone. It is a three universities – two continents team. Their challenge addresses the design of a social platform for sports industry. As opposite to Team A, in the early stage, Team B experiences only mild *dissonances* that are addressed and resolved in co-located settings. The team performs extremely well in the first milestone compared to others and it is above average in the second one. As everyone agrees on the course of action, team decides to distribute the tasks. Starting at this point, *mutual listening* is not as easy as before anymore, *dissonances* arise, of which the team members are only partially aware. The final co-located meeting unveils the *dissonances*, which the team is not prepared to deal with. Consequently, they remain partially unresolved and the team performs below expectations and below average.

Team C consists originally of three, and after first milestone four students, from two universities located in the same country. It aims at designing an innovative collaboration platform for financial industry. Due to the arrival of new team member, it has a period of active *harmony* maintenance, which is conducted seamlessly along the team tasks and activities. Intensive *mutual listening* produces awareness of *dissonances*, which are either immediately resolved or kept open for a short period of time. None of the strategies is detrimental to the team. On the contrary, it supports creative problem solution. Whereas the team was considered average in the first milestone, it outperforms other teams in the last one.

5 Artifact Design

While analyzing the previous cases, one recognizes the influence of team *harmony* on the overall creative process and the dynamics of particular groups. Creating novel products or business models requires constant supply of new ideas, which, in the described design thinking course, come primarily from the team as well as the potential users and their environment, coaches and project partners. Still, regardless of the idea origin, it is the team, who assembles the prototypes while converting the ideas and combining them with the domain-specific knowledge and observations. This creative process has particularly much in common with improvised jazz music, where music emerges harmonic and rhythmical combination of chords. Whereas a jam session is mostly a timely limited gathering, creative collaboration as described above is an ongoing improvisation performance lasting for several months.

As previously indicated, the presented teams perform pretty well if working synchronously at the same place. Mostly, they are able to deal with local, short-term *dissonances* and *consonances* in a way that supports their creative output. *Harmony* maintenance happens simultaneously to the main activities, without dedicated reflection and adjustment time. Even though, we cannot assume all co-located sessions to be absolutely optimal, the above analysis as well as received feedback suggest that they form the highlights of the development process. Traditionally, four modes of collaboration emerged which aligned to the dimensions of space (co-located/distributed) and time (synchronous/asynchronous) [61]. Unfortunately, some collaboration patterns, even if successful in co-located and synchronous setting, cannot be easily transferred and applied to the overall process of creative project work. In the innovation projects, there will necessarily be phases of distributed individual or subgroup work – this holds for the DT course as well as for creative innovation teams in organizations. The reasons range from the absence of a single team member up to the dissemination of team members across countries and time zones. Also, recent disputes show the fundamental role of individual work for creative introverts [10]. Given the importance of collaboration distributed across space or time, we ask how to support teams at maintaining *harmony* in settings others than synchronous work.

Hitherto, as the literature review on GSS (*Group Support Systems*) and CSS (*Creativity Support Systems*) unveils, little has been done to address team creativity in the context of *harmony* in asynchronous settings. Whereas CSS addresses such concepts as *playfulness*, *comprehension* and *specialization* of knowledge [71] as ways of stimulation, it does not explicitly address conflict that may occur in stimulated teams [34, 47, 64]. GSS addresses issues of consensus and effective decision making in creative problem solving, it does however primarily focus on co-located sessions [39, 50]. It provides process support through communication parallelization, anonymity, group memory, and media effects, as well as task and process structure, and task support [50]. Still, its usage for *harmony* maintenance is limited. While considering the JI metaphor, task *harmony* shall emerge from collaboration practices and not from intensive reflection, which lies in focus of *group decision support systems*, a branch of GSS. We intentionally stress the difference between explicit conflict management and

tacit *harmony* maintenance, and model the latter while taking co-located, synchronous collaboration as our gold standard.

Given the dependencies depicted in Fig. 1, it seems natural to consider the level of *mutual listening* in the first line. Participators of off-line group ideation sessions find themselves in a situation, where listening to one another happens naturally and is mostly successful. However, as soon as teams are distributed, keeping awareness of who is sending something into the common communication channel and what is the content of the message is by far more difficult. There exist tools to support distributed synchronous teams working in a creative or problem-solving mode. They fall into the category of *conferencing systems*, *media spaces* [66] and *collaborative virtual environments* [5]. Teams working asynchronously, but at the same place, can manage this awareness by observing changes in the working environment (notes on the walls, prototypes left on side, etc.). Also, in file sharing services that are widely used for distributed, asynchronous work, some mechanisms for supporting awareness are implemented. However, they mostly focus on the issue of time- or dependency-based coordination of team activities [9] and fail to address some of the other user expectations [54]. This section explicitly addresses an extended view on asynchronous awareness aligned to the notion of *mutual listening* as derived from JI metaphor.

We describe a simple, exemplary interaction paradigm that supports team members at maintaining a constant mutual notion of what others do, thus allowing for early *dissonance awareness* and appropriate reaction to this. It also provides simple means to resolve *dissonances* or keep them to assure idea divergence, although it does by no means limit the teams in their choices. The mechanism, we propose, relies on the division of the common repository into two distinct spaces: (1) the individual spaces of team members, depicted in Fig. 2 by the peripheral bubbles with names, (2) the central team space, 'We', including elements currently relevant for the whole team and therefore describing the *general tenor* of development within the team. If, within a predefined period of time, an element is attended by more than the half of the team, it will automatically move to the middle, thus showing the team awareness of its content. If a specific element from 'We' remains unattended for a longer period of time, it returns to its owner, who is then able to discard it.

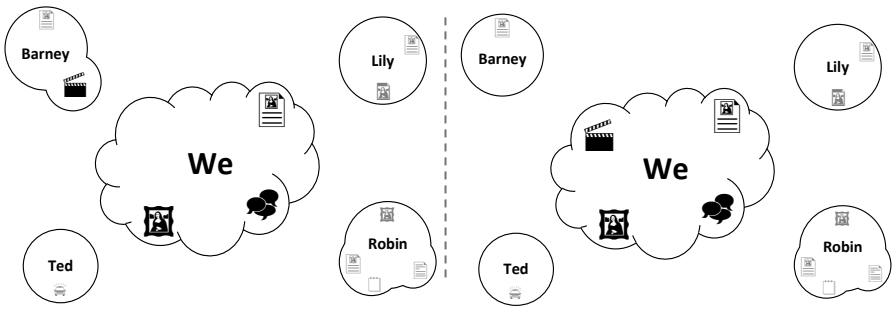

Fig. 2. Sketch representing basic notion of asynchronous *mutual listening* mechanism.

We deliberately apply the word ‘element’ instead of ‘file’ or ‘document’. It is natural, that in a process including co-located setting, some work artifacts are real things and may be represented in the repository in some underspecified form. Another important feature of the proposed mechanism is the versioning that allows to review team performance and attend forgotten elements. Team members can also ‘un-attend’ an element if they are not sure of its compatibility with the *general tenor*. Teams that stand in a phase of stronger *dissonance* realize it through the small size of the ‘We’-space compared to the individual spaces.

Fig. 2 depicts the basic interaction mechanism introduced for this exemplary application of *harmony* perspective. In general, one can see the team members along with their individual spaces and the central space. Each team member can attend any element regardless of its location. One can see that *Robin* has four different elements she works on, while *Barney* has two, one depicted as a document and one as a video. It is indeed a video prototype of a new service he proposed to the team. He has been extensively working on it for the last days, which is signalized by the ‘gemmating’ bubble. If at least two other members open and watch the video within a week, it will automatically move to the ‘We’ space. We propose one week as the control period of time due to the character and rhythm of the design thinking course, but any other time frame is possible.

With this proposition we address all levels of *harmony* maintenance discussed in the previous chapters and propose the following design principles. Below we summarize them given the developed requirements.

Table 2. Requirements and design principles for support of team *harmony* in long-term setting

Requirement	Design Principle
DR 1. Provide interaction paradigm that encourages *mutual listening* within the team	To reach DR 1, limit the number of elements considered common team output to the ones attended by the majority of team members.
DR 2. Provide means for seamless *dissonance awareness*	To reach DR 2, visualize the ratio of files within the common space and distributed among individual spaces.
DR 3. Provide means for seamless *dissonance resolution*	To reach DR 3, include a mechanism for automatic forgetting the files from common space.

6 Discussion and Conclusions

Concept and constitution of team *harmony*. This contribution introduces a novel framing for analyzing role of tensions, incompatibilities and disagreements in creative teams. It relies on the jazz improvisation metaphor and draws on the music notion of *harmony*, adopted for the first time to describe processes in creative teams. It depends on the notion of an improvised jam session, where music emerges through novel composition of preexisting and not yet known parts. Addressing our first research questions, we opened up with a rigorous literature review on task conflict and accompanying tension in creative teams. While focusing on studies from organizational and

semi-organizational, long-term context, we elaborated on factors influencing or moderating creative performance and disagreements in teams. We ended up with a *harmony*-oriented view on team creative performance, which in its core includes a model of team *harmony* (cf. Fig. 1). It consists of the following layers: *mutual listening*, *dissonance awareness*, and *dissonance resolution*. We postulate that well performing creative teams will seamlessly maintain *harmony*, at least in synchronous, co-located sessions. We also assume, that it is possible to support teams at this particular activity by means of IT systems and process improvements. The concept of *harmony* and its constituents was evaluated through cognitive walkthrough, based on the observations made in a specific and creativity-oriented organizational context. The introduced model contributes to the knowledge base on conflict in creative teams and opens new possibilities to frame research questions and possible results.

Designing support for *harmony*. Given the capabilities coming with the introduced concept of *harmony*, we applied the collected insights in design of an exemplary system to support *harmony* in teams. It incorporates *harmony* maintenance in standard actions of users, thus supporting the idea of seamless interaction. It relies on a simple mechanism that limits the number of elements considered common team output and provides constant feedback on the ratio between individual, possibly incompatible or dissonant actions, and the concerted ones. Even though the proposed paradigm was designed to be implemented in an IT system, it is possible to adapt it as a process to creative teams working in different settings. Thus, it can be easily applied by practitioners and moderators of creative processes.

Limitations and Outlook. The current study discloses a practical gap in the field of CSS / GSS, and, at the same time, it contributes to a better understanding of processes in creative teams. Still, we do not postulate our research to be accomplished or terminating. On the contrary, we recognize that our literature review is not complete, even though rigorously conducted and documented. Nonetheless, it was sufficient to develop and motivate the proposed model of team *harmony*. Our primary focus on teams in organizational context excluded much valuable research done in classes or labs – attending this literature could provide further theoretical clues on *harmony* in creative contexts. Moreover, further practical evidence can be attained through implementation of the proposed paradigm in real teams. The latter could benefit from a holistic system that encompasses findings from the fields of CSS and GSS, thus a closer look in those fields is still pending. In that sense, we look forward to future research that uses the notion of team *harmony* and adds to it. Herewith, we call for further investigation of *harmony* issues in the context of creativity and innovation.

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